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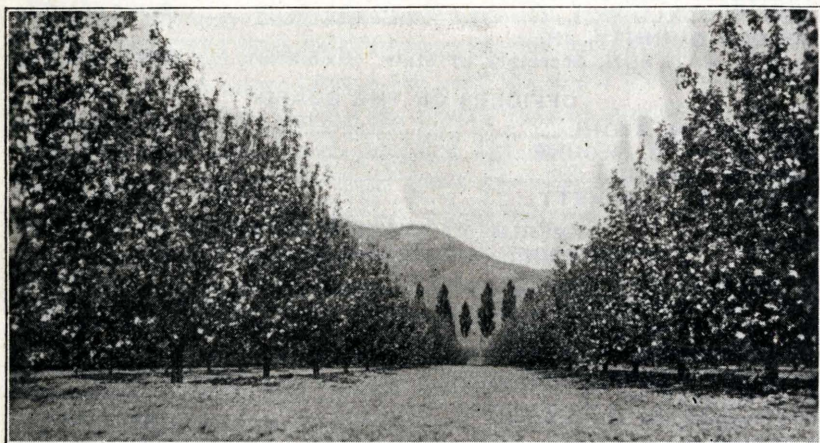
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Utah Agricultural College
EXPERIMENT STATION

Bulletin No. 140



The Summer Pruning of a Young
Bearing Apple Orchard

BY

L. D. BATCHELOR and W. E. GOODSPEED

Logan, Utah, November, 1915

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THE SUMMER PRUNING OF A YOUNG BEARING APPLE ORCHARD

By L. D. BATCHELOR and W. E. GOODSPEED

The majority of horticultural writers seem to favor the summer pruning of apple trees. The practice, and the arguments made in its favor vary widely and in some instances seem almost contradictory. On the other hand some experimenters and practical workers have obtained negative results by summer pruning from the view-point of crop production and tree growth. Dickens¹ caused unproductive ten year old apple trees in Kansas to bear satisfactorily during the fourth year of summer pruning. The Gardners' Chronicle² compiled the opinions of more than one hundred eighty-five fruit growers who practiced summer pruning, and about 82% of these orchardists reported satisfactory results while the remainder expressed doubts as to the value of the practice. Opinions compiled from English fruit growers by the Journal of Royal Horticultural Society³ (1908) showed that the consensus of opinion was uncertain as to the effects of summer pruning and that much depended upon soil, climate, varieties and season of practice. Drinkard⁴ checked wood growth and greatly stimulated the formation of fruit buds by summer pruning but one year.

The lack of unity on this subject only points out the many factors which must be considered in giving advice on this matter or in planning investigational work which is intended to throw light on this problem. Any treatise on summer pruning of apples must take into consideration many of the following factors which will bear directly on the results obtained: nature of both the summer and winter pruning practiced, variety, stock, root development, age of trees, soil and climatic conditions. If the orchard is within the irrigated sections the amount and season of available water must also be considered. With these factors in

1. Kan. Sta. Bull. 136, p. 181, 1916.

2. Gard. Chron. 3. ser. 41 (1907) No. 1069, pp. 400-403; 406, 407.

3. The Summer Pruning of Fruit trees. Jour. Roy. Hort. Soc. 33 part 2: p. 487-499. 1908.

4. Vir. Sta. Tech. Bull. 5. p. 119; 1915.

mind the writers planned an investigation on this subject during the summer of 1911.

Description of the Orchard.

The orchard chosen for this work was then the property of the late A. R. Hurst of North Logan, Utah. This orchard is typical in many ways of the apple orchards in the state of Utah and the other intermountain states.

The soil conditions are most favorable to apple production, namely, a well drained, deep, rich, sandy loam. The soil is of much the same consistency to a depth of six or eight feet with a water table about 58 feet from the surface. In the virgin state this soil was covered with a heavy growth of sage brush, which vouches for its natural fertility. Since being brought under cultivation it has been devoted to grain, alfalfa, orchard and the growth of sugar beets as a companion crop to the trees. During the first seven years of the orchard's existence while beets were grown among the trees, the soil was fertilized every other year with heavy application of stable manure. The soil is therefore in a high state of fertility for the growth of fruit or general farm crops.

The varieties include the Jonathan and Gano planted in alternate rows the long way of the orchard. By arranging the pruning plots the short way of the orchard, both of the above varieties were included in each plot.

The trees were budded on French stock and were two years old when planted. The entire surface has been irrigated by the furrow method, thus the root systems are well developed to a considerable depth and inter-lock with each other laterally.

The trees were five years old the spring the investigation was started. The Gano trees were about to produce their second crop, while the first crop of Jonathans was produced that year.

The trees had been annually pruned during the dormant season and presented an excellent example of vase shaped trees, a type common to the inter-mountain states.

The length of the growing season is sufficient for the production of the late maturing apples, such as the Gano or Winesap.

An abundance of irrigation water is available. It has

usually been necessary to water the orchard four times during the latter part of the growing season, from July 1st to September 15th. Much more water could be used if necessary.

Plan of the Experiment.

In outlining the work it was planned to compare plots pruned only in the dormant season, with similar plots pruned during the dormant season and at different intervals during the summer. There were fourteen trees—six Jonathan and eight Gano—in each plot when the experiment was started. One tree (Gano) was discarded from each of plots, 1, 7 and 9 during the first summer because of collar rot. Nine similar plots were laid off, and pruned as follows:

Plot 1, to be pruned in February or March, cutting out the cross limbs, crotches, opening up the center, and thinning out the bearing wood of the tree. No limbs to be headed back and no pruning to be done other than at the above season.

Plot 2, pruned as Plot 1, during February or March, and all the suckers to be removed from the center of the tree from time to time during the summer.

Plot 3, same as Plot 1, except the excessive growth in the top of the tree is to be cut back to lateral outside limbs in an endeavor to make the tree take a more spreading and less upright form.

Plot 4, pruned as No. 1, during February and March, and summer pruned in a similar manner to remove suckers and open up the dense growth of the tree during the third week in June.

Plot 5, pruned similarly to Plot 4, except summer pruning was done the first week in July.

Plot 6, same as Plot 4, except summer pruning was done the third week in July.

Plot 7, similar to Plot 4, except summer work was done the first week in August.

Plot 8, all pruning similar to Plot 4, except summer pruning was done the third week in August.

Plot 9, unpruned.

Thus five plots were pruned during the summer, one every two weeks interval from the third week in June until the third week in August.

Experimental Methods.

The summer pruning was similar in every way to the nature of the winter pruning. Crossing and parallel limbs were removed, and the fruiting wood thinned out here and there where it seemed to be crowded. In removing water shoots from the center of the tree, the cut was always made close to main limbs and no stubs were ever left.¹

Measurement of the crop production of marketable fruit together with a measurement of the annual twig growth have been the chief means of determining the effect of the several types of pruning. General notes were also kept on the size and color of

Table I.—Showing Distribution* of Twig Growth* Throughout the Season and Total Growth.—Jonathan Apple Trees.

Plot	1912		1913				Total		1914				Total		1912-13-14	
	Aug.	June	June	July	July	July	Aug.	June	June	July	July	July	Aug.	Grand	Total	Total
	3.	12	23	3	13	23	3.	12	23	3	13	23	3.			
1.	11.7	5.0	6.4	8.0	10.9	11.0	11.3	7.98	9.18	9.70	10.3	10.5	10.72	33.72		
2.	12.1	4.0	5.7	6.0	8.4	9.9	9.9	7.65	8.46	10.04	10.14	10.26	11.16	33.16		
3.	12.2	5.4	6.7	8.6	9.6	9.8	13.4	8.15	9.19	10.38	10.46	10.50	10.65	36.25		
4.	11.30	4.8	6.4	6.5	9.0	10.9	11.0	7.72	9.58	11.04	10.62	11.36	11.36	33.66		
5.	9.7	6.2	7.3	7.7	10.0	10.1	10.1	8.19	9.84	10.62	11.08	11.35	12.06	31.86		
6.	9.9	5.3	7.2	8.9	10.0	10.2	12.3	8.77	11.24	12.58	12.66	13.60	14.54	36.74		
7.	8.6	5.6	5.7	8.3	12.5	13.2	13.2	9.31	11.22	11.36	12.18	12.28	14.70	36.50		
8.	10.3	6.7	8.4	9.3	10.5	10.6	10.7	9.89	10.96	11.22	11.42	12.38	14.38	35.38		
9.	10.6	3.37	3.37	3.38	3.38	4.0	4.1	6.30	7.9	8.10	8.50	9.38	11.70	26.40		

*Average of 100 measurements.

Table II.—Showing Distribution of Twig Growth* Throughout the Season and Total Growth.—Gano Apple Trees.

Plot	1912		1913				Total		1914				Total		1912-13-14	
	Aug.	June	June	July	July	July	Aug.	June	June	July	July	July	Aug.	Grand	Total	Total
	3.	12	23	3	13	23	3.	12	23	3	13	23	3.			
1.	12.7	4.7	5.4	7.2	8.8	8.8	8.9	8.18	8.55	9.27	10.80	10.84	10.94	32.54		
2.	15.1	5.1	5.8	8.2	8.2	9.5	9.7	9.30	9.37	10.74	10.74	10.76	11.03	35.83		
3.	14.4	7.8	7.8	10.5	12.0	12.0	12.1	10.08	11.20	11.80	12.80	13.20	14.04	40.54		
4.	13.3	6.4	6.9	9.6	9.7	10.1	10.2	9.40	11.50	11.24	11.90	12.50	13.20	36.70		
5.	12.8	7.4	7.5	7.5	9.6	10.8	10.8	9.92	11.68	12.85	13.14	13.43	14.96	38.56		
6.	11.2	7.6	8.8	9.1	10.5	10.6	10.7	9.87	11.56	12.70	12.78	13.26	14.83	36.73		
7.	15.8	7.4	7.4	7.5	9.3	9.9	10.6	10.07	11.73	11.80	12.61	13.26	13.37	39.77		
8.	12.9	8.1	8.2	9.8	10.7	11.7	12.6	9.58	11.76	11.90	12.31	13.11	15.42	40.92		
9.	13.3	6.2	6.3	6.3	6.4	6.4	6.5	6.27	8.60	9.51	10.04	11.95	12.68	32.48		

*Average of 100 measurements.

1. Pruning the water shoots to stubs has been persistently practiced by some of the orchardists of the locality, but always with negative results as far as crop was concerned, according to all observations the writers have been able to make.

the fruit and vigor of the trees. There was sufficient crop of Gano apples to warrant thinning all the plots to a minimum distance of five inches during the years 1912 and 1914. The Jonathans were similarly thinned during the latter season only.

Twig growth measurements were not commenced until the end of the season of 1912. They were made periodically every ten days throughout the growing season of 1913 and 1914. The results of these measurements are shown by Table I and II referring to the Jonathan and Gano plots respectively. Similar effect is noted on both varieties.

Experimental Data.

Plot 3 on which the excessive upright growth in the tops of the trees was cut back to lateral growth in an attempt to make the tree more spreading, produced a noticeably larger twig growth than plots 1 and 2. The latter plots were similarly

Table III.—Showing Average Yield of Jonathan Trees under Different Methods of Pruning.

Plot	Method of Pruning	Yield	Yield	Yield	Yield	Total
		1911	1912	1913	1914	Ave.
		lbs.	lbs.	lbs.	lbs.	lbs.
1	*Winter pruned only.....	50	208	82	327	667
2	Winter pruned and all suckers removed from center of tree during the summer.....	37	150	69	389	645
3	Winter pruned with excessive growth in top of tree removed to outside lateral limbs.....	14	200	31	323	568
4	Winter pruned. **Also summer pruned third week in June.....	33	141	66	356	596
5	Winter pruned. Also summer pruned first week in July.....	41	141	50	281	513
6	Winter pruned. Also summer pruned third week in July.....	16	125	8	200	349
7	Winter pruned. Also summer pruned first week in August.....	16	116	32	204	368
8	Winter pruned. Also summer pruned third week in August.....	20	112	57	312	501
9	Unpruned.	35	141	59	342	577

*All winter pruning done during February or March.

**Summer pruning consists of removing suckers and opening up dense growth.

pruned except there was not heading back practiced. The summer pruned plots (4-8) averaged a greater total growth during the three years than plots 1 and 2 which were similarly pruned during the winter time only. This was true of both varieties with only one exception; Jonathan Plot 5 averaged a total growth of 31.86 inches while plots 1 and 2 averaged 33.44 inches. In the case of both varieties the unpruned plots made a less total growth than the pruned plots; comparing in the ratio of 26.4 to 34.7 and 32.4 to 36.4 for the Jonathan and Gano respectively.

The crop production for the Jonathan plots is shown in Table III. The variation between Plot 1 and 2 was only slight, the average production per tree for the four years for the above plots being 667 and 645 pounds respectively. Rubbing the water shoots off of Plot 2 had little or no influence on crop production. These water shoots, however, are so much more readily and cheaply removed during the growing season that it will usually pay to remove them at this time because of the saving in labor. Plot 3, which was pruned to cause the trees to spread as much as possible, averaged 88 lbs. less fruit per tree during the four years than Plots 1 and 2 on which no heading back was practiced. The summer pruned Plots 4 to 8 average 191 lbs. of fruit less per tree for the four years than Plots 1 and 2, which were pruned during the dormant period only. The summer pruned plots also averaged 112 pounds of fruit less per tree than the unpruned plots for the four years. Plots 1 to 2 which were pruned in the ordinary manner during the dormant season only, averaged 79 lbs. of fruit per tree more than the unpruned Plot 9.

The variation among the total production of the summer pruned Plots 4 to 8 is within the realm of chance except for Plots 6 and 7 which were noticeably low. This was thought to be caused by the fact that these two plots, through causes of no interest here, were more severely pruned during the summer of 1913 than the other plots in question.

Turning now to Table IV which shows the crop production of the Gano plots, much the same comparisons and relative results can be seen. Plots 1 and 2 varied only as much as might be expected between any equal number of trees picked at random in the orchard. These two plots averaged 1055 lbs. per tree while Plot 3 averaged 965 lbs. or 90 lbs. less per tree.

This was due in part at least to the character of pruning which aimed to spread the trees of Plot 3 as much as possible by cutting back the long terminal growth in the tops of the trees, to the lateral branches. The same results were seen on the Jonathan plots. By the continued efforts of trying to make low spreading trees of Plot 3, no doubt more of the future fruiting wood was removed, and there was a continual attempt on the part of the trees to resume their more natural upright habit. This only bears out the practical advice of earlier horticultural writers. On the subject Bailey writes as follows:¹ "The most rational pruning—when fruit and the welfare of the plant are chief concerns—is that which allows the plant to take its natural form, merely correcting its minor faults here and there." Gardner² favors the thinning out rather than the heading in of the apple

Table IV.—Showing Average yield of Gano Trees under Different Methods of Pruning.

Plot	Method of Pruning	Yield 1911 lbs.	Yield 1912 lbs.	Yield 1913 lbs.	Yield 1914 lbs.	Total Ave. yield.
1	*Winter pruned only.....	73	400	147	441	1061
2	Winter pruned and all suckers removed from center of tree during the summer.....	107	243	221	478	1049
3	Winter pruned with excessive growth in top of tree removed to outside lateral limbs.....	78	243	147	497	965
4	Winter pruned. **Also sum- mer pruned third week in June.....	106	193	179	478	956
5	Winter pruned. Also summer pruned first week in July.....	93	225	165	470	953
6	Winter pruned. Also summer pruned third week in July.....	100	131	224	420	875
7	Winter pruned. Also summer pruned first week in August.	92	185	232	446	955
8	Winter pruned. Also summer pruned third week in August.	84	175	251	438	948
9	Unpruned.	39	228	342	547	1156

*All winter pruning done during February or March.

**Summer pruning consists of removing suckers and opening up dense growth.

1. The Pruning Book, p. 150.

2. Ore. Sta. Bull. 130, p. 56, 1915.

branches for the purpose of increasing the formation of fruit spurs, under Oregon conditions.

The summer pruned Plots 5 to 8 inclusive, show only a small amount of variations well within the realm of chance. The average of these plots again fell below the Plots 1 and 2, which were similarly pruned in the dormant season only. The comparison is as follows: Average pounds of fruit per tree for four years on winter pruned plots 1055,—summer pruned plots—937

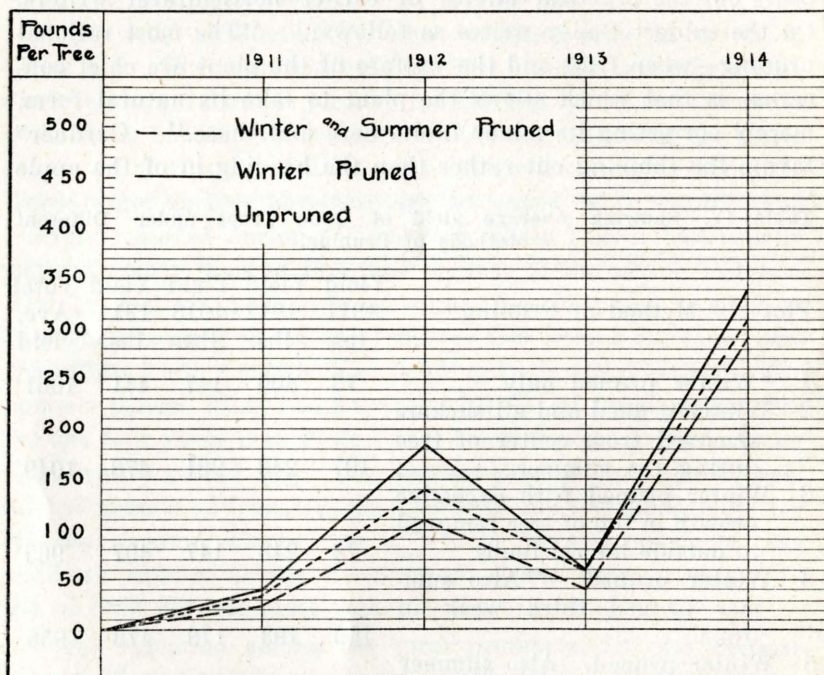


Fig 1—Yearly average production of Jonathan trees under different systems of pruning.

lbs., or a reduction of 112 lbs. per tree. If the entire orchard had been summer pruned it would have caused an average reduction in yield during the past four years of 257 boxes per acre³ or an average of $64\frac{1}{4}$ boxes per year.

With the Gano variety there was an increase yield on the unpruned Plot 9 of 101 lbs. per tree compared with Plots 1 and

3. This is based on 50 lbs. of fruit per box. There are 115 trees per acre in the orchard under consideration.

2 which were winter pruned. This is more than off-set, however, as will be seen later by the difference in the quality of the fruit, and the added cost in thinning. It will be interesting to see whether the unpruned plot can continue its annual large crop production and outyield the pruned plots. Bedford¹ and Pickering report that unpruned trees out-yielded pruned trees nearly three to one at the end of twelve years experimentation.

The unpruned plot averaged 219 pounds per tree more for the four years than the summer pruned trees. This is approxi-

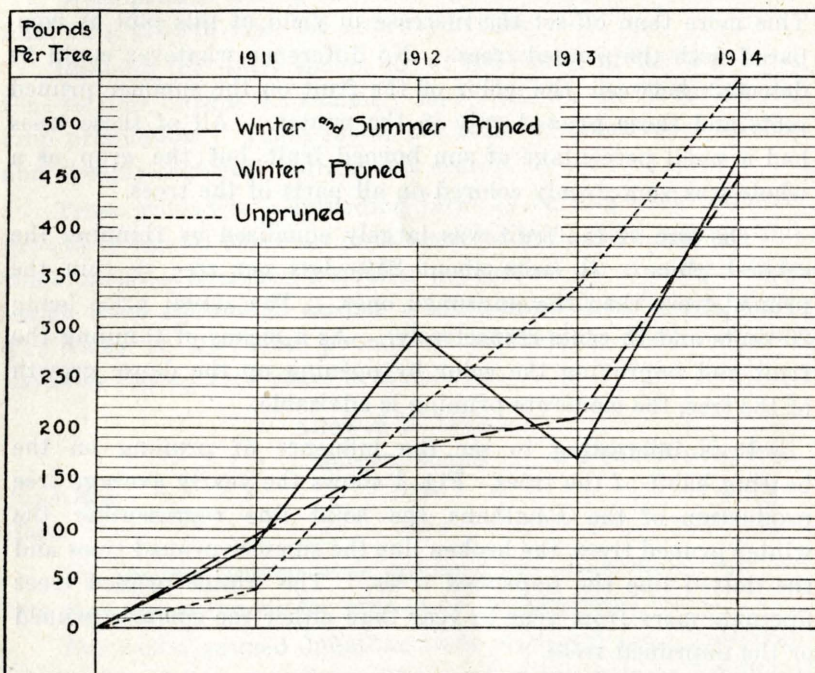


Fig 2—Yearly average production of Gano trees under different systems of pruning.

mately a box per tree per year or a yearly reduction of 115 boxes per acre, charged against this style of pruning.

It should be noted here that the orchard under experimentation is far from being an unproductive orchard. The winter pruned plots produced very satisfactory commercial results. Summer pruning therefore, was not undertaken in an attempt to

1. Woburn Exp. Farm. Rpt. 7 (1907)

cause barren trees to become fruitful, but rather to test the value of summer pruning in connection with winter pruning where trees were already producing crops at least equal to average of the region.

The color of the fruit on the several plots has not varied materially except the unpruned Plot 9 has gradually become slightly inferior concerning this factor. This was most noticeable on the lower limbs. During the season of 1914 the fruit on Plot 9 had only about 70% as much color as the other plots. This more than off-set the increase in yield of this plot as compared with the pruned trees. No difference whatever could be detected between the color of the fruit on the summer pruned plots and those pruned only in the winter. All of these trees had a small percentage of sun burned fruit but the crop as a whole was very evenly colored on all parts of the trees.

The size of the fruit was largely equalized by thinning the several plots. It costs about 25% less per tree to thin the pruned trees than the unpruned ones. The actual price being 20 cents and 15 cents respectively. As a means of thinning the fruit and improving the color by opening up the dense growth of the tree, the moderate pruning is advisable.

It is interesting to see the influence of pruning on the bearing habit of the trees. Fig. 1 shows the yearly average tree production of the Jonathans, the solid line representing the winter pruned trees, the broken line the summer pruned trees and the dotted line the unpruned trees. The winter pruned trees fluctuate more from year to year than either the summer pruned or the unpruned trees.

The Gano plots are represented by Fig. 2. Here again the winter pruned plots show the greatest fluctuation in crop production from year to year. The summer pruned plots are much more regular in their production, while the unpruned plot shows a very regular and gradual increase in productivity as the trees have become older. The Gano trees came into bearing one year before the Jonathans which may be instrumental in making the curves in Fig. 1 and 2 somewhat dissimilar. The individuality of the varieties is no doubt also responsible for part of this variance.

SUMMARY.

Apple trees which were pruned to induce a spreading habit by cutting back the terminal growth to lateral branches, produced a greater annual twig growth than trees which were similarly pruned except the terminal growth was untouched.

Trees pruned during the dormant period and also during the summer, produced a greater annual twig growth than trees pruned during the dormant season only.

Trees pruned during the dormant season produced a greater total twig growth than the unpruned trees.

Rubbing the water shoots out of the center of the tree from time to time during the summer, had little or no influence on crop production. These shoots are removed much more readily and cheaply, however, during this season.

Trees pruned to a spreading form by cutting back terminal growth to lateral branches in the case of both the Jonathan and Gano varieties averaged a smaller production per tree than trees which were allowed to assume a more natural upright growth. The ratio of the total pounds of marketable fruit for two varieties during four years is as follows:

	Allowed to take natural shape.	Pruned to spread.
Jonathan	100	86
Gano	100	91

The summer pruned trees averaged less marketable fruit per tree than either the winter pruned or the unpruned trees.

The winter pruned Jonathan trees produced more fruit than the unpruned trees. The winter pruned Gano trees produced less fruit than the unpruned trees.

Summer pruning in this orchard has proven neither profitable nor successful in increasing crop yields.

Although the investigation is only in its first stages, there seems to be a correlation between regular bearing and summer pruning.

In the case of the Gano trees the most regular bearing trees were the unpruned ones.

Summer pruning throughout a period of two months between

the third week in June and the third week in August produced much the same results.

The above results may apply only to young, vigorous bearing apple trees of the Jonathan and Gano varieties when planted on a rich, sandy loam, free from seepage, in semi-arid climate, with an abundance of irrigation water available. These varieties under the above conditions show a tendency to over-bear soon after reaching a productive age, and are usually thinned; summer pruning reduces the area of fruit bearing wood, the vitality of the tree and the productivity.